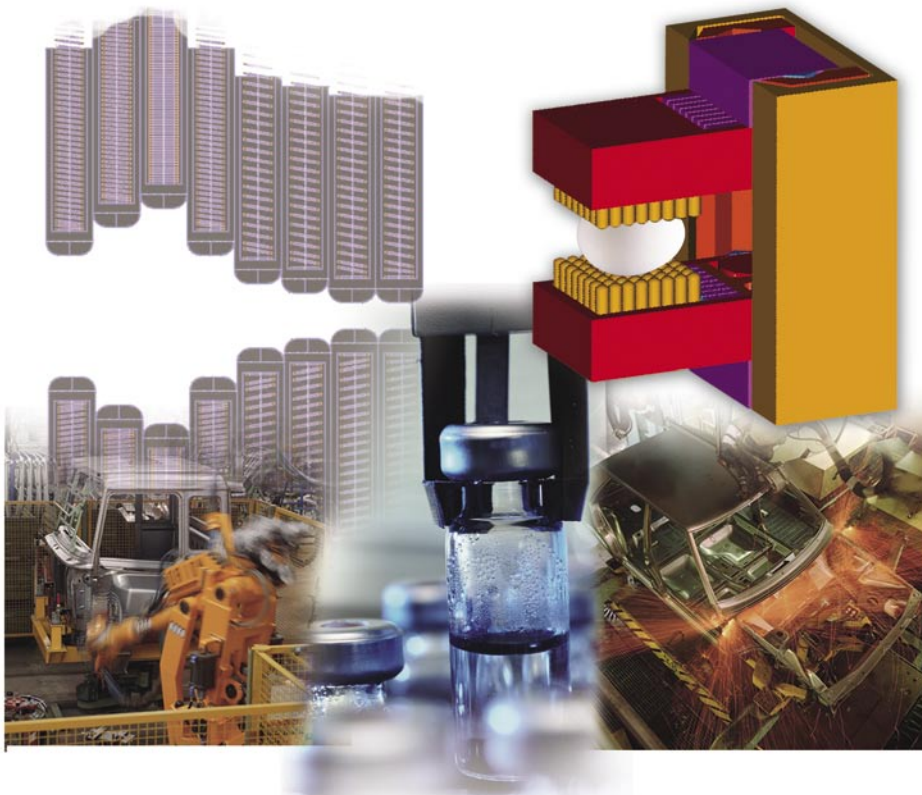




National  
Aeronautics  
and Space  
Administration

# Superior Conformal Robotic Gripper

... holds any shape gently yet securely with minimal force



NASA Goddard Space Flight Center invites companies to license this unique robotics gripping mechanism for commercial applications. Designed for use in repair or assembly, the gripper gently conforms to any object's shape and then locks into position for an extremely secure yet gentle hold. Even with significant external force or torque, the gripper prevents fragile or irregularly shaped objects from moving.

## Benefits

- **Gentle:** The gripping mechanism uses pins that gently flex to the shape of the object, distributing the load force and eliminating the likelihood of crushing fragile objects.
- **Precise:** Extremely precise pin movements allow the gripper to hold even very small objects.
- **Secure:** Novel mechanism secures pins, each with a surface locking strength of 500 psi. The locking forces do not affect the positions of the pins, so the pins retain their softly preset shape.
- **Versatile:** The conformal gripper can also serve as a tool or as a means for end-effector exchange.
- **Reduces costs:** The gripper's conforming mechanism eliminates the need for special purpose end effectors to grasp objects.
- **Saves time:** Because it conforms to any shape, the gripper saves time by eliminating the need to change end effectors to grasp and manipulate various objects.

## Applications

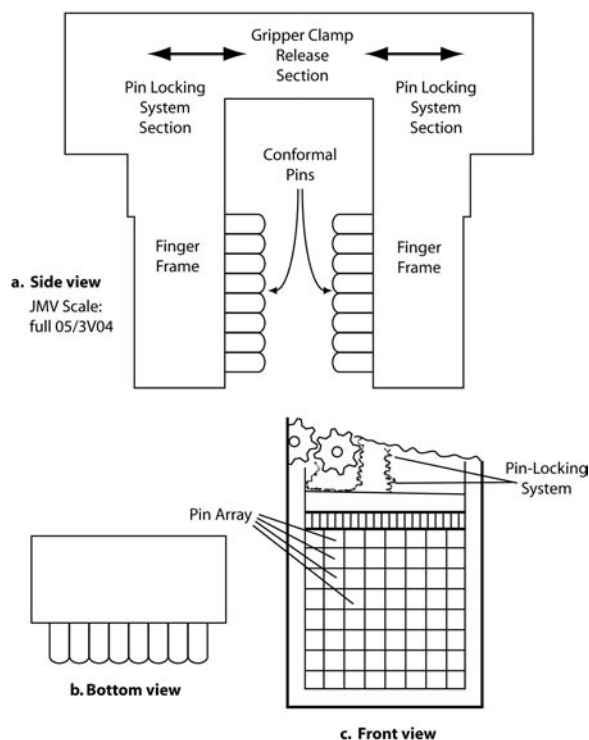
### Robotics

- End effectors
- Adaptive tool holders
- General purpose adaptive tools

### Computer numerical control (CNC) manufacturing

- Flexible manufacturing cells
- Adaptive fixturing for parts manufacturing/assembly
- Adaptive end effectors

Figure 1. Conformal Gripper Overview



## The Technology

This conformal gripper is composed of parallel jaws (fingers)—each with a matrix of 64 pins—sensors to measure the shape of the object, and a control mechanism for directing the shape and stiffness of the pins at each point of contact with the object's surface.

### How it works:

Using a super high-speed reduction epicyclical transmission, the locking mechanism within each "finger" holds the pins firmly in place until released. The locking mechanism transfers and distributes force to the pins using a press and an articulated flexure system. Because each pin responds individually to the object's shape, the motion of one pin does not affect the motion of others. Each pin in the matrix has a spring that brings it back into a predetermined position in the absence of other forces.

With each of the pins in its relaxed position, the conformal gripper fingers open and center on the object. As the gripper fingers close upon the object, the surfaces of the pins within each finger conform to the object's shape. The controller then hardens that shape and locks each pin into position. Once grasped, the object cannot be pulled or twisted from the hold without extreme force or torque. The object can, however, be repositioned for further work in a different area. Once work has been completed on the object, the gripper fingers open to release it.

### Why it is better:

The unique design of the conformal gripper enables grasping and firmly holding even fragile and irregularly shaped objects without requiring special purpose robotic end effectors. This gripper does not rely on friction to hold an object as existing devices normally do.

NASA Goddard is pursuing patent protection for this technology.

## Partnering Opportunities

These devices are part of NASA's Innovative Partnerships Program, the goal of which is to transfer technologies into and out of NASA to benefit both NASA space missions and the American public. NASA invites companies to consider licensing this conformal robotics gripper technology for use in commercial applications.

## For More Information

If you are interested in the conformal robotics gripper, please contact:

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